Agriculture. It is impossible here to summarize the report, itself a summary. Certainly every American who understands the past success and future plans of this bureau must feel proud that our government is thus leading the world in turning applied botany, based upon researches by a capable staff, to the production of wealth and comfort for the people. As a mere matter of dollars and cents, any one of a dozen or more discoveries made or practically applied by this bureau recently will add to the annual income from our fields and gardens more than the whole bureau has cost from its beginning. The report is a concise and clear showing that will interest all and will surprise those who have not followed closely the recent developments.—C. R. B.

THE BULLETIN from the laboratories of natural history of the State University of Iowa contains in its last issue (Vol. V, no. 4) two botanical papers on the local flora, viz., *The flora of the St. Peter sandstone in Winnesheik Co., Iowa*, by Professor B. SHIMEK: and *The Discomycetes of eastern Iowa*, by FRED J. SEAVER. In the latter, out of nearly one hundred species collected in the state, about fifty are described and illustrated in twenty-five plates, the remainder being reserved for further study. No new species are described.—C. R. B.

THE SECOND ANNUAL ISSUE of the volume on Botany of the *International Catalogue of Scientific Literature*[3] was published in December last, the manuscript having been completed in March 1904. There is no occasion to explain the scope and quality of this publication, for it has already been extensively reviewed,[4] and the opinions of botanists concerning it have become well settled.—J. M. C.

J. PERKINS[5] has issued the third fascicle of contributions to the flora of the Philippines. The collaborators are as follows: C. DE CANDOLLE, Piperaceae; J. PERKINS, Rutaceae; O. WARBURG, Ulmaceae, Moraceae, Urticaceae, Balanophoraceae, Aristolochiaceae, Magnoliaceae, Thymelaeaceae, Ericaceae, and Ficus; E. B. COPELAND, Ferns (38 n. spp. and *Christopteris*, n. gen.).—J. M. C.

NOTES FOR STUDENTS.

RECENT STUDIES IN HYBRIDIZATION.—The literature of Mendelian inheritance has been enriched by the appearance of several important recent papers. TSCHERMAK[6] gives an account of further studies in the hybridization of peas, stocks (Matthiola), beans, etc., which have given him so many noteworthy results reported in earlier contributions. The great amount of interesting detail makes adequate review impossible in a short note. "Kreuzungsnova," which have

[3] International Catalogue of Scientific Literature. M. Botany. 2d annual issue. 8vo. pp. 1111. London: Harrison & Sons, 45 St. Martin's Lane. 1904. 37s. 6d.

[4] BOT. GAZETTE **34**:455. 1902.

[5] PERKINS, J., Fragmenta Florae Philippinae. Fasc. III. pp. 153–212. *pl. 4.* Leipzig: Gebrüder Borntraeger. 1905. *M*5.

[6] TSCHERMAK, E., Weitere Kreuzungsstudien an Erbsen, Leukojen und Bohnen. Zeits. Landw. Versuchsw. **7**:533–638. 1904.

usually been considered uncommon, he has found to result regularly in seventeen of the hybrids that he reports. Races which show the possession of such latent characters that are externalized as a result of crossing he has designated in another recent paper[7] as "cryptomeric" races, and the process of externalization of latent characters as "cryptohybridism." In many cases the new characters are recognizable as atavistic, in other cases they appear to be retrogressive or degressive modifications. The processes by which these arise he calls "hybrid atavism" and "hybrid mutation," and he looks upon the latter as an important source of new forms, especially of "defect-races."

In nearly all cases the new characters as well as the parental characters behaved in a Mendelian way. Thus in a cross between two races of peas, white-flowered × rose-colored gave complete dominance of red (atavistic) in the first generation (F_1) splitting in F_2 to red: rose: white = 9:3:4, the red dominating the rose, and red + rose the white, in the simple ratio 3:1. In a case of this kind the red is called "dominant" and rose "co-dominant." In other cases "co-recessives" occurred, giving four forms in the second generation, the ratio being 9:3:3:1. A still further complication was found in a cross between white-flowered *Matthiola glabra* and red-flowered *M. incana*, in which pure violet dominated in F_1 and five forms appeared in F_2, giving approximately the proportions 27:9:9:3:16. This last result was reported by TSCHERMAK two years ago, and he explained it by assuming that each of the four colors (the fifth class being the white recessives) is a compound, $a+b$, $a+d$, $b+c$, and $c+d$, and on this assumption he predicted then what would be the product of each of these groups in F_3 when self-fertilized. The third generation is here presented, showing that in every instance his prediction was confirmed.

LOCK[8] obtained very similar results in crosses of various cultivated peas with species native at Peradeniya, Ceylon. Thus with respect to seed-color, self-colored × white gave in F_2 self-colored : purple spotted : white = 9:3:4, and another case precisely resembling that of TSCHERMAK's Matthiolas gave categories of seed-coloration in the second generation nearly in the ratios 27:9:9:3:16. The explanation offered by LOCK is essentially the same as TSCHERMAK's, though differently expressed. He assumes that the allelomorphs ABC in the colored pea are matched by corresponding recessives abc in the white, but that neither B nor C can reach external expression except in the presence of A. The chance combinations of gametes containing these allelomorphs then result in the observed ratios.

LOCK's paper gives an admirable general treatment of Mendelism, illustrated with new examples taken from his own studies, and presents briefly but fairly the results of other workers. It can be recommended to any one who wishes to

[7] TSCHERMAK, E., Die Theorie der Kryptomerie und des Kryptohybridismus. Beihefte Bot. Centralbl. **16**:11–35. 1904.

[8] LOCK, R. H., Studies in plant breeding in the tropics. Ann. Roy. Bot. Gard. Peradeniya **2**:299–356. 1904.

orient himself with the least possible expenditure of time and effort in the important fields which have been opened up by MENDEL and his belated successors.

EMERSON[9] gives a continuation of his studies in bean hybrids, in which he now treats his results statistically, instead of qualitatively as in his preliminary report two years ago. The numbers are mostly not large, but considering the smallness their agreement with the theoretical ratios is fairly close. The chief interest in EMERSON'S results is the class of characters investigated, often making classification difficult, and considerable error probably being introduced in this way. A few of these characters with the dominant member of the pair given first are as follows: running habit (flowers axillary), bush habit (flowers terminal); pods tender, pods tough; pods green, pods yellow. In the case of stringless *vs.* stringy pods, about half the crosses showed the former dominant, the other half being intermediate; though all the progeny from any given cross behaved consistently. EMERSON shows that no prediction can be made regarding the hereditary behavior of seed-color from knowing the relations obtaining in other hybrids having the same seed-color, a fact also noted by TSCHERMAK in the first paper mentioned above.

CORRENS[10] has reported the results of further observations on hybrids of *Hyoscyamus niger*, *H. pallidus*, and *H. major*. The former crossed with its var. *annuus* shows complete dominance of the biennial habit with typical splitting in F_2 and later generations. *H. pallidus* × *H. niger*, which was reported in a previous paper as giving intermediate flower color in F_1, is now shown to split typically in later generations, regardless of the annual or biennial habit of the offspring and independently of evironmental conditions.

CORRENS[11] has also investigated the hereditary relations of gynodioecism, dealing chiefly with *Satureja hortensis* and *Silene inflata*. In the former species bisporangiate flowers crossed together showed a predominance of bisporangiate plants in F_1, but when stigmas of the ovulate plants were pollinated with pollen from bisporangiate plants the offspring were almost without exception ovulate. In Silene the results were very similar, ☿×☿ giving almost entirely ☿, and ♀×☿ resulting in a predominance of ♀. This is quite contrary to Mendelian expectation, and the author does not believe that sexuality can be aligned under ordinary laws governing characters of hybrids, which it will be recalled has been attempted by CASTLE[12] with reference to animals.—G. H. SHULL.

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[9] EMERSON, R. A., Heredity in bean hybrids. Ann. Rept. Agr. Exp. Sta. Nebraska **17**:33–68. 1904.

[10] CORRENS, C., Ein typisch spaltender Bastard zwischen einer einjährigen Sippe des *Hyoscyamus niger*. Ber. Deutsch. Bot. Gesells. **22**:517–524. 1904.

[11] CORRENS, C., Experimentelle Untersuchungen über die Gynodioecie. Ber. Deutsch. Bot. Gesells. **22**:506–517. 1904.

[12] CASTLE, W. E., The heredity of sex. Bull. Mus. Comp. Zoöl. **40**:187–218. 1903.

PENHALLOW[13] has recently published the first and general part of an extensive treatise on the anatomical determination of the North American Coniferales as well as certain species from Japan and Australia. The memoir represents the results of a quarter of a century's work in this field and is of great importance from the paleobotanical and phylogenetic standpoints. Although the author expresses his appreciation of the value of a general anatomical study of the group, he limits himself to the structural features of the ligneous cylinder, for the reason that coniferous remains are ordinarily best preserved as fragments of wood. Wood structure is discussed under the following headings: spiral tracheids; bordered pits, distribution and structure; medullary rays; resinous tracheids and resin cells; and resin passages.

Under the caption of bordered pits, the author points out that multiseriate and crowded pits deformed by mutual pressure are characteristic of the older gymnosperms, the Cycadofilices, Cordaitales, etc. Bordered pits are in general confined to the radial walls of the tracheids, exceptions to this mode of distribution occurring only in the primary wood and in the autumnal tracheids of the annual rings. Under the heading of medullary rays, the various types of structure which are of diagnostic importance are clearly and definitely described, and in this respect the present work marks a long advance on its predecessors. Two types of ray are distinguished, namely the linear ray made up of a single series of cells, and the more complex fusiform ray, which is so broad as to contain a horizontal resin canal. Resinous tracheids are described as diagnostic for the Araucarineae, but also occur sporadically in certain species of Abies. Resin cells, according to the author, appear in the more primitive conifers (exclusive of the yew-like Taxineae) and are characterized by their scattering, zoned, or segregated distribution, the latter condition being considered the most specialized. Where the resin-cells are highly segregated they may give rise schizogenously to resin cysts of limited extent, with walls constricted at intervals. Resinous cysts are found characteristically in the abietineous genera Tsuga and Abies, but also occur in living and extinct Sequoias. In the abietineous genera Larix, Pseudotsuga, and Picea, the resin spaces form a continuous system of vertical and horizontal passages, which according to the author betray their derivation from resin cysts by the constricted character of their walls. In Pinus the resin passages no longer show signs of constriction and are moreover lined entirely with thin-walled epithelium.

The author, as the result of plotting frequency curves based on the occurrence of the various characters of the wood, reaches certain conclusions as to phylogeny which may be briefly stated as follows: The Taxaceae are the oldest of the Coniferales, and from their general plexus have branched off on the one hand the Podocarpeae, and on the other the common trunk, which gave rise to the Taxo-

[13] PENHALLOW, D. P., The anatomy of the North American Coniferales together with certain exotic species from Japan and Australia. Part I. American Nat. **38**: 243–273, 331–359, 523–554, 691–723. 1904.

dineae, Cupressineae, and Abietineae in approximately ascending order. The Araucarineae, contrary to the usual opinion, have a separate and direct origin from the Cordaitales. The conclusions reached by the author from the study of wood harmonize on the whole very well with those adopted in general taxonomic works such as Engler and Prantl's *Die natürliche Pflanzenfamilien*, and are based on the assumption that greater complexity of structure is necessarily characteristic of more modern forms. There is of course room for difference of opinion on this subject, in view of the evidence of general paleobotany, comparative anatomy, and development, which seems to show that the Coniferales form a series of recession rather than of progression. There can be no doubt, however, as to the very important character of the facts brought out by the investigations of Professor PENHALLOW, and the second part of the memoir, which is to contain the specific determinations of the conifers from the structure of their wood, will be awaited with interest.—E. C. JEFFREY.

JEFFREY[14] has published the second of his contributions to our knowledge of the anatomy of the Coniferales, in so far as it bears upon relationships and phylogeny. The immense service that anatomy of this kind is rendering to morphology that concerns itself with phylogeny cannot be overestimated. The student of gymnosperms is particularly indebted to JEFFREY for the studies he is just now prosecuting, for this new method of attack could not have been directed more usefully than upon Coniferales. In the preceding number of the series the author has reached the conclusion that Sequoia shows an abietineous origin, and it was natural that a presentation of the Abietineae should follow. No better summary of his results could be given than that prepared by the author himself; and since the subject is one of much general interest and importance no apology is needed for reproducing it here.

1. The Abietineae are divisible, on the evidence supplied by a study of their vegetative and reproductive organs, into two distinct subfamilies, viz., the Pineae and the Abieteae.

2. The Pineae are characterized by the invariable presence of resin canals, forming an anastomosing system in the secondary wood and cortex of root and shoot. Resin canals are present in the outer margin of the primary wood of the root. The scales of the female cone are not deciduous. Pinus, Picea, Larix, Pseudotsuga.

3. The Abieteae ordinarily do not possess resin canals in the secondary wood of root and shoot. Resin canals, however, are sometimes found in the wood of the female reproductive axis, and in the first annual ring of vigorous shoots of sexually mature trees. Resin canals occur in the secondary wood in tangential rows, as a result of injury. Resin canals are invariably found in the center of the primary wood of the root. The scales of the female cone are generally deciduous. Abies, Pseudolarix, Cedrus, Tsuga.

4. The evidence derived from anatomy and experimental morphology goes to show that the presence of resin ducts in the woody tissues and in the cortex of the Abietineae

[14] JEFFREY, EDWARD C., The comparative anatomy of the Coniferales. Part 2.—The Abietineae. Memoirs Boston Soc. Nat. Hist. **6**:1–37. *pls.* 1–7. 1904.

is primitive for the group. The resin canals persist longest in the reproductive axis, the leaf, and the *first* annual ring of root and shoot. In the more specialized genera the resin canals of the wood are replaced by resin cells, but in the latter condition of the wood, resin canals may always be recalled as a result of injury. The disappearance of resin canals and their replacement by resin cells is probably for the sake of economy of carbohydrate material. In Pseudolarix and Tsuga even the cortical resin canals disappear from all organs except the female reproductive axis, together with its appendages, and the vegetative leaf.

5. The Abietineae are an older group than the Cupressineae, in the larger sense, and are either antecedent to these or from the same ancestry. This conclusion is reached from an anatomical and experimental morphological study of their organs, root, shoot, and leaf. It is confirmed by the examination of the female reproductive organs and of the pollen. It is further in conformity with paleontological evidence.

6. The Abietineae are throughout characterized by the same double leaf trace which is a constant feature of the older gymnosperms, the Lyginodendreae, the Cordaitales, the Ginkgoales, and the Cycadales. This feature serves to separate them from the Cupressineae in the larger sense, and to unite them with the Cordaitales, which they resemble in other important particulars, described in the body of the memoir.

7. The Abietineae must be regarded on comparative anatomical and morphological grounds as a very ancient order of the Coniferales, and may even be the oldest living representatives of this group.—J. M. C.

SKOTTSBERG,[15] botanist of the Swedish Antarctic Expedition of 1901-1903, gives a preliminary report on the phytogeographical conditions in the Antarctic regions. He proposes for the lands south of 40-50° S. the following names: *Austral* zone, including Terra del Fuego, with the Isla de los Estados, the Falkland islands, South Georgia, and no doubt the South Sandwich islands; and *Antarctic* zone, including South Orkney and South Shetland islands, and Graham Land. An objection must be raised against the use of the terms Antarctic and Austral for local geographical areas such as the author is speaking of. The reviewer had recently (in a paper read before the Philadelphia meeting of A. A. A. S. 1904) occasion to mention in passing that the name of Austral zone for a certain phytogeographical area of North America was incorrect, and he holds a similar opinion in regard to SKOTTSBERG'S use of the term. What is to be called the Austral zone? Certainly not a limited area in South America with a few neighboring oceanic islands. We have at present an almost endless number of phytogeographical divisions, and this is not the place to enter upon a discussion of the relative merits of these, but it seems proper here to point out that if we are ever to get a consistent nomenclature in phytogeography it will not do to apply to local or minor areas names generally used to designate larger divisions. The Arctic region is recognized by DRUDE and ENGLER, for example, as a subdivision of what the former calls the Northern realm and the latter the North extratropical realm. MERRIAM gives to this Northern realm the name Boreal region. The reviewer

[15] SKOTTSBERG, C., On the zonal distribution of South Atlantic and Antarctic vegetation. Geographical Journal 655–664. 1904.

would call it the Boreal realm, of which the Arctic region constitutes a part. In the southern hemisphere we have a corresponding Austral realm, of which the Antarctic region is a subdivision. What SKOTTSBERG now calls the Austral zone is a region that may be designated as Patagonian, or Fuegian, or Magellanian, or by some other local name, and which is a division of equal rank to the Antarctic, subordinating this and several other regions under the term Austral realm. Our criticism here refers to the use of the terms only, not to the author's definition or limitations of the areas under consideration. In regard to the flora of the South Atlantic ocean, the author considers that the division into Austral and Antarctic is just as evident as in the land flora. Until the detailed results of the expedition are made known and until this question is thoroughly discussed, final judgment in the case must be reserved.—OLSSON-SEFFER.

IN A PAPER READ before the B. A. A. S. last August, CZAPEK presents[16] a fuller account of his researches on the anti-ferment reaction which occurs in tropistic movements, especially of roots. In geotropically stimulated roots, for instance, homogentisinic acid, a product of decomposition of tyrosin by tyrosinase, accumulates slightly, instead of being oxidized at once, because an anti-enzyme is produced by the stimulation, which inhibits the action of the oxidase. The quantitative determination of the homogentisinic acid is not practicable as a measure of the reaction, but a solution of homogentisinic acid may be used as a reagent for determining by titration the retardation of its oxidation by the anti-oxidase. The roots to be tested are ground in water with powdered glass to a thin paste, and a standard solution of homogentisinic acid added; the initial reducing power of the wash is determined. and repeatedly at intervals of five days, by titration with $n/10$ $AgNO_3$. CZAPEK finds that only tropisms produce the anti-enzyme; narcosis, poisoning, mechanical hindrance of growth, and wounding having failed by themselves to produce the reaction. Six minutes was determined to be the limit for roots placed horizontal at 17° C. to show the anti-enzyme reaction, which persists for about four hours. Though not observably intensified by prolonged stimulation of the root, it persists for a much longer time, even up to thirty hours after fifty minutes stimulation. The reaction becomes certain for thirty minutes induction at an angle of 7° from the normal and at 10° is maximal, remaining constant up to 170°; decreasing very much at 176°, and not showing at all at 180°. By reducing the time of induction it can be shown that the reaction is stronger at 135°–150° than at horizontal, which assists in settling a disputed point. Roots rotated on the klinostat show the reaction, clearly supporting the view that geotropic stimulation occurs under such conditions though curvature does not result. This reaction also confirms CZAPEK'S experiments with glass slippers, showing that more than the root cap with its statolith cells is involved in the geotropic phenomena. He lists these phenomena (assuming them to be consecutive) thus:

[16] CZAPEK, F., The anti-ferment reaction in the tropistic movements of plants Ann. Botany **19**:75–98. 1905.

(1) statolith effect; (2) anti-ferment reaction; (3) the processes hindered by shock; (4) transmission of stimulus; (5) curvature.—C. R. B.

A NOTABLE FEATURE of the recent meetings of the affiliated scientific organizations at Philadelphia was the annual discussion before the American Society of Naturalists, which this year had for its subject the mutation theory. Two of the seven addresses were botanical, D. T. MACDOUGAL opening the discussion from the standpoint of plant-breeding, and L. H. BAILEY presenting the taxonomic bearing of the theory. In the opening address MACDOUGAL[17] stated the main thesis of the mutation theory thus: "the saltatory movement of characters, regardless of the taxonomic value of the resultant forms," its principal corollary being "that the saltations in question do result in the constitution of new species and varieties." He believes that many current misconceptions regarding species are due to the failure to discriminate between elementary species and the composite or "group" species of the systematist; and that there is accumulating evidence that the supposed deleterious effects of close-fertilization are groundless. Warning is given of the confusion which must arise through the unguarded use of the terms "mutation" and "variation" to designate phenomena of segregation and alternative inheritance in hybrid strains. It will be recalled in this connection that in a previous paper MACDOUGAL[18] has discussed the difference between fluctuating and mutative variations, and has included as mutative variations only "newly arisen and transmissible qualities," emphasizing the fact that it is a pure presumption to designate any aberrant condition a mutation until its hereditary character has been demonstrated. Regarding the causes of mutations little is known, but the results of the mutation cultures both at Amsterdam and at New York are held to indicate that they arise in greater numbers under environmental conditions which are especially favorable for vegetative development and seed-production. Some mutations occur much more frequently than others, and the highest total number of mutants found in any progeny of *Onagra Lamarckiana* in New York was over six per cent., as compared with the five per cent. maximum observed by DE VRIES in Amsterdam. Report on other mutating species is promised for the near future.—G. H. SHULL.

THE ECONOMIC importance of LUTHER BURBANK'S achievements in plant breeding, and a certain mystery which has surrounded his work owing to his inability or unwillingness heretofore to impart information regarding the methods he uses, have won for him the appellation "wizard of horticulture." An attempt[19] to present to the public an account of the methods employed and some of the results obtained is welcome, and the name of President JORDAN adds to the

[17] MACDOUGAL, D. T., Discontinuous variation and the origin of species. Torreya **5**:1–6. 1905.

[18] MACDOUGAL, D. T., Mutation in plants. Amer. Nat. **37**:737–770. 1903.

[19] JORDAN, D. S., Some experiments of Luther Burbank. Pop. Sci. Monthly **66**:201–225, *figs. 22.* 1905.

authoritative character of the account. The presentation is given in the form of quoted paragraphs from conversations with BURBANK, and the assurance is given that these have been referred to him for verification. This method certainly has advantages which to some degree counterbalance the disconnectedness and the frequent repetition of ideas which necessarily result from it. There is nothing new or unusual in the methods employed by BURBANK, namely, "selection, crossing, hybridization, and mutation," and it is apparent that his success is dependent upon his great activity rather than upon the methods used. This paper is of great scientific interest, but of little scientific value, and emphasizes with unusual force the difference between the economic and scientific ideals. It will be a source of information to scientists, but certainly of a great deal of misinformation to the general public, with whom the source of the statements made will carry a weight wholly incommensurate with their scientific value. It appears to the reviewer that the compiler of these paragraphs from BURBANK'S conversations owed it to his readers to explain two features of the technique employed which would lead to a correct valuation of the statements made. "Strawberry-raspberry hybrids" cause less surprise when it is known that insufficient precautions were taken to prevent the entrance of foreign pollen of unknown origin; similarly, when apple-trees grow from blackberry seeds it is well to bear in mind that the seeds were sown in unsterilized soil. The discussions of the mutation theory and other subjects bearing upon evolution will prove amusing.—G. H. SHULL.

ITEMS OF TAXONOMIC INTEREST are as follows: EDITH M. FARR (Contrib. Bot. Lab. Univ. Penn. **2**:417–425. 1904) has described a new species of Pachystima from the Selkirks of British Columbia.—W. A. MURRILL (Bull. Torr. Bot. Club **31**:593–610. 1904), in his ninth paper on the Polyporaceae, has described *Laetiporus*, *Trichaptum*, and *Pogonomyces* as new genera.—J. A. SHAFER (Torreya **4**:177–181. 1904) has separated a new species of Cassia (*C. Medsgeri*) from *C. marilandica*.—In continuing their account of the flora of western Australia, L. DIELS and E. PRITZEL (Bot. Jahrb. **35**:161–528. 1904) describe numerous new species and also a new genus (*Psammomoya*) of Celastraceae.—EDWARD L. GREENE (Leaflets **1**:81–96. 1904) has segregated from Streptanthus many of the Californian plants that have been referred to it, and has established the following genera to include them: *Euclisia* (14 spp., 3 new), *Pleiocardia* (9 spp., 2 new), *Mitophyllum*, *Microsemia*, and *Mesoreanthus* (3 spp., 2 new); has replaced *Chlorogalum* Kunth by the older *Laothoe* Raf.; has recognized *Aloitis* Raf. as represented by *Gentiana quinqueflora occidentalis* and adds two new species; and has described new species of Batrachium (2) and Sophia (2).—B. F. BUSH (Trans. Acad. Sci. St. Louis **14**:181–193. 1904) has monographed the Texan species of Tradescantia, recognizing 18 species, 10 of which are new.—P. A. RYDBERG (Bull. Torr. Bot. Club **31**:631–655. 1904), in his 13th "Studies on the Rocky Mountain flora," has described new species in Dodecatheon, Gentianella, Gilia (6), Polemonium (2), Lappula (2), Oreocarya (2), Mertensia (6), Stachys, Mon-

ardella, Solanum, Pentstemon (3), Castilleia (3), Valeriana (2), Coleosanthus, Grindelia (2), Gutierrezia (2), Chrysopsis (4), Solidago (6), Oligoneuron, Chrysothamnus (2), and Aster (5).—J. M. C.

LYON[20] has stated more in detail his views as to the phylogeny of the cotyledons of angiosperms. The monophyletic origin of angiosperms is argued with considerable fullness; a view which recent anatomical studies have helped to establish, and to which there is probably little dissent at present. The cotyledons are regarded as primarily haustorial organs, related phylogenetically to the so-called foot of bryophytes and pteridophytes; a view which seems to be well taken and cogently argued. The monocotyledonous condition is claimed to be the primitive one among angiosperms, the dicotyledonous condition being derived from it through the "bifurcation" of the originally single cotyledon. This last view is probably the only one that will meet serious opposition, since the recent studies of the comparative anatomy of the vascular systems of the two groups have contributed great strength to the view that monocotyledons have been derived from dicotyledons. However, this detail does not affect the general claim as to the nature of cotyledons. Beginning with the sporophyte of bryophytes, in which the body is differentiated into two regions called "sporophore" and "haustrum," the latter is traced through into the angiosperms and shown to include cotyledon, hypocotyl, and primary root. In fact, the hypocotyl is regarded as a new "haustral" structure that is differentiated between the root and the sporophore. The term "protocorm" is used instead of "proembryo" for the undifferentiated embryo, and "metacorm" for the "plant body after the differentiation of its permanent members." The author announces that a paper is in preparation in which he "will endeavor to demonstrate the validity of his hypothesis concerning the phylogeny of the cotyledon."—J. M. C.

NĚMEC has brought additional facts to the support of the statolith theory of geotropic perception.[21] Roots from whose tips 1^{mm} has been cut show geotropic curvatures after 20 hours, because the regenerating tip consists of cells with large mobile starch grains. Roots with 1.5^{mm} removed remain straight, having no such new cells. The regeneration of the perceptive complex is not always complete before the root becomes geotropic, certain older cells often acquiring motile starch grains and perceptive sensitiveness. He also adduces further evidence from the behavior of inverted root-tips and replies to objections based upon the results with glass-capped roots, where thigmotropic curvatures (this in the face of NEWCOMBE'S results) may enter. Against CZAPEK'S objection, that the chemical differences between stimulated and unstimulated roots are observed whether the statocysts are present or not, it is suggested that there

[20] LYON, HAROLD L., The embryo of the angiosperms. Amer. Naturalist **39**: 13–35. 1905.

[21] NĚMEC, B., Einiges über den Geotropismus der Wurzeln. Beihefte Bot. Centrlbl. **17**:45–60. 1904.

may be two kinds of perception, of which that by heavy starch grains alone leads to curvature, the other (*e. g.*, by radial pressure) leads to the chemical changes —a strained answer. After defending his ideas against some criticisms by NOLL and by MIEHE, he pays his compliments to WIESNER'S objections based on *Clivia nobilis* and *C. miniata*, the former being geotropic, while the latter is not. But NĚMEC finds both confirm the statolith theory, inasmuch as in *C. nobilis* there is abundant motile starch in the perigonial leaves, and none in *C. miniata*. Statolith starch is found widely distributed in mosses. It is wanting in certain geotropic liverworts (*Metzgeria furcata*), abundant in the strongly geotropic *Trichocolea tomentella*, and scarce in the weakly geotropic *Plagiochila asplenioides*.—C. R. B.

STRASBURGER[22] gives a popular but strictly scientific discussion of the genus Alchemilla as it occurs on the Grand Salève at Geneva. At least thirty-one species of this genus are found on this one mountain where LINNÉ recognized only three. No wide gaps separate these species, but their distinctive characters are fully constant in inheritance. The author contrasts the Linnean conception of species as an abstraction with the present conception in which a species is a real entity which he defines as a group of individuals that agree among themselves, and are separated from other species by definite characters that they inherit, however slight these characters may be. The species of Alchemilla are believed to be the result of a rather recent period of mutation, the evidence of its recency being found: (*a*) in the want of marked gaps between the species, which would result through the extinction of some species by natural selection; (*b*) the almost perfect development of stamens rendered functionless by the apogamous habit of nearly all species; (*c*) the marked development of nectaries that are likewise functionless and secrete no nectar. The species are regarded as apogamous rather than parthenogenetic since no reduction of the chromosomes occurs. No case of parthenogenesis in this sense is yet known among higher plants. Alchemilla is paralleled with two other noteworthy apogamous genera, Taraxacum and Hieracium, both of which likewise show numerous elementary forms, and it is suggested that the apogamous habit of these genera may have resulted through excessive mutation that introduced continuous hybridizations with attendant deterioration of the sexual processes.—G. H. SHULL.

IN AN ADDRESS before section K of the British Association, WARD[23] has given an extremely interesting review of the growth of our knowledge of parasitism among the fungi and bacteria, from the researches of DEBARY to the present time. The first part of the paper deals with the more important earlier discoveries which have marked distinct phases or epochs in the advancement of this subject, notably those of A. BRAUN, DEBARY, TULASNE, COHN, KOCH, and others.

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[22] STRASBURGER. E., Unserer lieben Frauen Mantel. Eine phylogenetische Studie. Naturw. Wochenschr. **20**: 49–56. 1905.

[23] WARD, H. MARSHALL, Recent researches on the parasitism of fungi. Ann. of Botany **19**: 1–54. 1905.

The latter part of the paper is occupied principally with questions brought out by recent discoveries and theories relating to the rusts. It is shown that the uredo stage is probably responsible for the wintering of many rust fungi whose distribution and annual recurrence is not easily explained by the regular alternation of teleuto- and aecidiospores. Specialized races, immunity, susceptibility, and related subjects are discussed. The mycoplasm theory of Eriksson is considered to be without foundation and absolutely erroneous in the light of the speaker's investigations. Students will find this a valuable paper for reference, outlining briefly the main questions that have occupied the minds of investigators at different periods in the development of mycology, while the bibliography of 209 titles is a means of easy access to the literature of the subject.

ERIKSSON[24] also read a brief paper on the vegetative life of the Uredineae. This paper is a review of his mycoplasm theory, mainly as set forth in his former papers.—H. HASSELBRING.

CAMPBELL[25] discusses in detail and combats BOWER'S theory that the spike of Ophioglossum is the equivalent of a single sporangium of Lycopodium and that all pteridophytes are reducible to a common strobiloid type. He repeats his belief, hitherto published, that the progenitor of the large-leaved ferns may have sprung from some bryophyte type, and that the Ophioglossaceae may have arisen directly from an Anthoceros-like prototype. He regards a species of Ophioglossum from Sumatra described by BOWER (Ann. Bot. **18**:205. 1904) as nearly realizing the hypothetical form suggested by him as the fern ancestor. The close relationship of the Ophioglossaceae and the Marattiaceae is pressed upon the grounds of structural resemblances in both gametophyte and sporophyte, and the conclusion is drawn that there is "no valid reason for removing the Ophioglossaceae from their association with the ferns." He also reviews the evidence offered by recent writers in regard to the likeness existing between the Marsiliaceae and the Schizaeaceae. He thinks there is a marked resemblance between the sporocarp of certain of the former group and the fertile leaf segment of Schizaea, both as regards structure and the origin of the sporangium. These features combined with "the remarkable correspondence in the structure of the sporangia" he considers sufficient evidence to ally the Schizaeaceae and the Marsiliaceae not remotely.—FLORENCE LYON.

IN CONTINUATION of his experiments with the Erysiphaceae SALMON[26] has established that injury to plants in various ways makes such plants susceptible to biologic forms of Erysiphe to which they are normally immune. The fungus

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[24] ERIKSSON, J., On the vegetative life of some Uredineae. Ann. of Botany **19**:55–60. 1905.

[25] CAMPBELL, D. H., The affinities of the Ophioglossaceae and Marsiliaceae. American Naturalist **38**:761–775. *figs. 9.* 1904.

[26] SALMON, E. S., Further cultural experiments with "biologic forms" of the Erysiphaceae. Ann. of Botany **19**:125–148. 1905.

used was the biologic form of *E. graminis* on wheat. This form will not infect rye, but by subjecting rye leaves to various treatments it was found that the fungus could be made to infect this plant also. When leaves of rye were injured either by cutting or bruising or by slugs, the cells around the injured parts could be infected with conidia or ascospores from *E. graminis* on wheat. Other experiments showed that rye leaves subjected to the influence of alcohol, ether, or heat become susceptible to infection from conidia taken from wheat. In some of these cases the fungus produced vigorous growth nearly covering the leaves. Conidia grown on barley in this way retained the power of infecting their original host, but were unable to infect normal untreated leaves of barley. These experiments are especially interesting, since they contribute an experimental proof to the generally current notion that plants of "weakened vitality" are more easily attacked by fungi than vigorous plants. The experiments show that at least in certain cases plants may become more susceptible as a result of injurious agencies affecting the general health of the plant.—H. HASSELBRING.

THE COMPLETED FORM of CLINTON'S[27] monograph of the North American Ustilagineae has recently appeared. This monograph is the result of studies carried on for a series of years at the University of Illinois and completed at Harvard University. The descriptions are based on the author's personal examination of type material so far as this was possible. To the technical descriptions are appended notes of interest giving the distribution of the species, and special characters of aid in separating closely related species. Complete synonomy and references to exsiccati are given, while a bibliography of over 200 titles is found at the end of the volume. A feature of the book is the tabulated list giving the distribution by continents of the species treated in the work. This volume forms an excellent handbook for the study and determination of the smuts of North America. It will prove extremely useful to students and station workers by whom the lack of monographs of groups of parasitic fungi has been long felt. It would have added to the utility of the work to have had the index of hosts arranged alphabetically, with page references for the parasites; instead of classifying the hosts according to orders, which is a time-robbing arrangement.—H. HASSELBRING.

GOEBEL[28] has previously shown that *Bryophyllum crenatum* will develop shoots from the growing region at the margin of the leaves if the midrib be severed, or if all the buds be removed from the shoot. Further studies[29] show that the same result follows if the buds be left intact, but inhibited from growing. All the

[27] CLINTON, G. P., North American Ustilagineae. Proc. Boston Soc. Nat. Hist. **31**:329–529. 1904.

[28] GOEBEL, K., Ueber Regeneration im Pflanzenreich. Biol. Centralbl. **22**:418. 1902.

[29] GOEBEL, K., Morphologische und biologische Bemerkungen. 14. Weitere Studien über Regeneration. Flora **92**:132–146. *figs. 6.* 1903.

growing points of several shoots were encased in plaster, and after four weeks' time buds appeared along the margin of the leaves. Upon removing the plaster the buds of the shoot continued growing. In this plant the leaf buds arise from already existing growing points. In Begonia, however, none of these are present on the leaf, and here also continued removal of the growing point of the shoot resulted in the development of buds on the leaves.

In *Streptocarpus Wendlandi* when the inflorescence is removed a number of the adventitious shoots develop. The interesting feature about these is that they present seedling characters, viz., each has a short shoot-like axis and one large leaf corresponding to the large cotyledon, the opposite leaf being almost invisible or entirely suppressed.—W. B. McCallum.

Leclerc du Sablon[30] finds that the carbohydrate and nitrogenous reserve foods of trees reach their maxima in the autumn, and their minima in May or June after the formation of the leaves and shoots of the season. For carbohydrates the roots are more marked reservoirs than the stems, and the leaves do not function as a storage place. Nitrogenous reserves, however, are more abundant in leaves than in stems or roots, diminishing from spring to autumn, at first very rapidly, then slowly. The stem and roots give up to leaves in process of formation most of their nitrogenous food, and their store is replenished little by little during the season. The fats are scarce in stems or roots; they are more abundant in leaves, in which they increase from spring to autumn. Water is at a maximum in early spring and a minimum in autumn. Autumn, when the water is at a minimum and the reserve food at a maximum, is the most favorable time for the transplantation of trees. Sablon seems to have overlooked some important German work on reserve food in trees, especially that of Mueller.—C. R. B.

Bertrand[31] obtained from pure cultures of various orchids the same fungus, and found that the seeds of these species, sowed with this fungus (an Oospora?) to the exclusion of other micro-organisms, gave normal plants, regularly infested. Cypripedium seeds grown aseptically do not develop; Cattleya embryos grow to the spherule stage and no further unless then infected; *Bletia hyacinthina* develops a stem and some leaves, but does not pass this stage unless infected, when it pursues a normal course. The action of the fungus is to incite growth in cells other than those attacked. This knowledge will be useful to growers. In a discussion of tuberization Bertrand expresses the view that though tuberization is an anomaly of growth (from the morphological point of view) due to an abnormal concentration of the sap, in nature this concentration is brought about not by any of the methods of the laboratory (which have been urged as disproving this theory of tuberization), but by the attacks of endophytic fungi.—C. R. B.

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[30] Sablon, Leclerc du, Recherches physiologiques sur les matières de réserves des arbres. Rev. Gén. Bot. **16**: 341–368, 386–401. 1904.

[31] Bertrand, N., Recherches expérimentales sur les Orchidées. Rev. Gén. Bot. **16**: 458–476. *pls. 18–19*. 1904.

IT APPEARS from PORODKO'S work on the growth of bacteria and molds under different pressures of oxygen,[32] that the maximum pressure of this gas which can be borne varies, in twenty-five organisms studied, from 0.676 to 9.38 atmospheres. A single nutrient medium was used throughout, and the author points out that with other media perhaps the maximal pressures might have been different. The upper limit of oxygen pressure for optimal growth seems not to be related to the maximal pressure. Furthermore, every aerobe has its specific minimal pressure of the gas. This point lies considerably higher for the molds than for bacteria, being about 0.6 atmospheres for Aspergillus, Penicillium, and Mucor, while it is 0.00016 for *Bacillus subtilis*. Of course, in case of facultative anaerobes there is no minimum. The lower limit for most obligate aerobes lies low enough to allow the growth of obligate anaerobes.—B. E. LIVINGSTON.

MISS ROBERTSON,[33] in continuing her study of *Torreya californica*, has described the sexual structures and fertilization. Two to four archegonia are produced, the neck consisting of a single tier of four or six cells. The division of the central cell was observed, and an ephemeral ventral nucleus inferred. The two male nuclei were observed in a common cytoplasmic sheath, but no inequality in the male cells was noted. In fertilization the cytoplasm of the male cell was observed investing the fusion nucleus. In the development of the proembryo wall-formation occurs after four free nuclei have appeared. A count of chromosomes indicated that the reduction number is eight. The general conclusion is reached that the morphological evidence does not bear out the suggestion of cycadean resemblances obtained from the anatomy of the seed and seedling.—J. M. C.

GRÉGOIRE[34] has investigated the reduction of chromosomes in the pollen mother-cells of *Lilium speciosum* and *Allium fistulosum*. The immediate occasion for the investigation was that STRASBURGER'S recent conclusions[35] conflict with those of BERGHS,[36] a pupil of GRÉGOIRE. The present investigation convinces GRÉGOIRE that his pupil is correct in his interpretations, and that STRASBURGER'S recent interpretation of mitosis in *Thalictrum purpurascens* will not apply to Lilium, Allium, and Convallaria. The most interesting observation in the present paper concerns alternations of generation. GRÉGOIRE claims that since reduction is not complete until the four spores are formed from the

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[32] PORODKO, THEODOR, Studien über den Einfluss der Sauerstoffspannung auf pflanzliche Mikroorganismen. Jahrb. Wiss. Bot. **41**:1–64. 1904.

[33] ROBERTSON, AGNES, Studies in the morphology of *Torreya californica*. II. The sexual organs and fertilization. New Phytol. **3**:205–216. *pls. 7–9*. 1904.

[34] GRÉGOIRE, VICTOR, La réduction numérique des chromosomes et les cinèses de maturation. La Cellule **21**:297–314. 1904.

[35] STRASBURGER, EDUARD, Ueber Reduktionsteilung. Sitzungsb. K. K. Preus. Akad. Wiss. **18**:—. [1–28.] 1904. See BOT. GAZETTE **38**:397–398. 1904.

[36] BERGHS, JULES, La formation des chromosomes hétérotypiques dans la sporogénèse végétale I. La Cellule **21**:173–189. 1904. See BOT. GAZETTE **38**:228. 1904.

mother-cell, the gametophytic generation begins with the spore rather than with the spore mother-cell.—CHARLES J. CHAMBERLAIN.

BORGESEN and JENSEN[37] have given a floristic description of a portion of heath in Jutland, Denmark. On the suggestion of WARMING, a part of the estate now meadow has been reserved for experimental purposes, the object being to trace the developmental phases from cultivated soil to heath. Another portion of the heath was burned over in order to trace the progressive stages from no vegetation until the tract is again converted into the Calluna heath. Another object in view is to trace the succession of plants on areas which now are or are to be planted with conifers. The data of the present condition seem to be thoroughly detailed and classified. Hence it would seem that future observations on this tract will furnish interesting and valuable material for the ecologist.—G. H. JENSEN.

STOKLASA[38] reports the finding of lactic acid produced by the enzyme lactolase as one of the intermediate products of anaerobic respiration of gourds, beets, and potatoes, under aseptic conditions. Acetic acid and formic acids were also formed. Meanwhile BUCHNER has abandoned his contention that lactic acid is one of the intermediate products in alcoholic fermentation (with which STOKLASA absolutely identified anaerobic respiration), in the light of the researches of NEF. At the close of his paper STOKLASA hints darkly at results which indicate that chlorophyll-free plant cells form CHOH as in photosynthesis, the CO_2 being reduced by nascent H to formaldehyde, water being again formed. —C. R. B.

LIVINGSTON finds[39] that the cations of many metallic nitrates and sulfates act in the same way and at the same concentration upon Stigeoclonium, producing death at certain concentrations, causing the filamentous form to become palmelloid at lower concentrations, and sometimes at the latter concentrations, but oftener at a still lower one, accelerating in a marked degree the formation of zoospores. The palmella effect is identical with that produced by withdrawal of water, but the zoospore effect is exactly the opposite. The degree of toxicity of the metals found agrees in a general way with that found by other observers, though there are many unexplained discrepancies.—C. R. B.

ON THE BASIS of comparative researches with the quartz spectrograph, TSCHIRCH comes to the conclusion[40] that the yellow pigments of flowers and

[37] BORGESEN, —, and JENSON, —, En floristisk Undersögelse af et Stykke Hede i Vestjylland. (A floristic research on a portion of heath in West Jutland.) Bot. Tidsskrift **26**:———. 1904.

[38] STOKLASA, J., Ueber das Enzym Lactolase, welches die Milchsäurebildung in der Pflanzenzelle verursacht. Ber. Deutsch. Bot. Gesells. **22**:460–466. 1904.

[39] LIVINGSTON, B. E., Chemical stimulation of a green alga. Bull. Torr. Bot. Club **32**:1–34. *figs.* 17. 1905.

[40] TSCHIRCH, A., Vergleichend-spektralanalytische Untersuchungen, etc. Ber Deutsch. Bot. Gesells. **22**:414–439. 1904.

fruits betray no close relationship with artificial yellow pigments, a large number of both being investigated. Rather the plant pigments show alliances with the phytosterins. Carotin, he adds, probably is allied to THIELE'S *fulvin*, and its chromatophore radicles contain a quinate ring of which at least three C-atoms have double bonds.—C. R. B.

VUILLEMIN[41] has published a paper on the development and structure of the membrane of the zygospore in the mucors. The main contribution of the paper is the recognition of the fact that the membrane is more complex than has usually been supposed. The author distinguished five distinct layers which differentiate successively and differ from each other in thickness, appearance, and in their behavior toward reagents. The study includes Sporodinia, Spinellus, Zygorhynchus, and Mucor.—H. HASSELBRING.

AN INVESTIGATION under the direction of PALLADIN by L. PETRASCHEVSKY[42] shows that when *Chlorothecium saccharophilum* is fed with raffinose its respiratory quotient in anaerobic life is raised much above 1 (in aerobic life it is 0.74—0.89), while with maltose it falls below the normal. Acids are probably produced as decomposition products in the former case and alcohol-like substances in the latter.—C. R. B.

CULTIVATION in a greenhouse modifies notably the external form, the habit, and the structure of plants, according to the experimental studies of BÉDÉLIAN.[43] This he ascribes to the humidity, nearly uniform temperature, and the weaker diffuse light. In general differentiation is more or less arrested, and there are manifested various adaptations to the new conditions.—C. R. B.

FRIEDEL finds the effect of insufficient oxygen on the anatomy of certain plants quite parallel with that of darkness. The relative thickness of the cortex is increased, that of the pericyclic region is diminished, and lignification is incomplete.[44] The experiments, however, cannot be continued long enough to make these effects as marked as in etiolation.—C. R. B.

KELLICOTT[45] finds in roots of Allium and Podophyllum two maxima (*c.* 11 and 1 P. M.) and two minima (*c.* 7 A. M. and 3 P. M.) in cell division, which are not affected by slight variations in temperature, but are affected by solutes in tap water. Elongation maxima and minima in Allium coincide respectively with minima and maxima in cell division.—C. R. B.

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[41] VUILLEMIN, P., Recherches morphologiques et morphogéniques sur la membrane des zygospores. Ann. Mycol. **2**:483–506. *pls. 8–11.* 1904.

[42] PETRASCHEVSKY, L., Ueber Atmungscoefficienten der einzelligen Alge *Chlorothecium saccharophilum*. Ber. Deutsch. Bot. Gesells. **22**:323–327. 1904.

[43] BÉDÉLIAN, J., Influence de la culture en serre sur quelques plantes des environs de Paris. Rev. Gén. Bot. **16**:318–336. *pls. 10–13.* 1904.

[44] FRIEDEL, JEAN, Influence d'une faible pression d'oxygène sur la structure anatomique des plantes. Rev. Gén. Bot. **16**:305–317. 1904.

[45] KELLICOTT, WM. E., The daily periodicity of cell division and of elongation in the root of Allium. Bull. Torr. Bot. Club **31**:529–550. *figs. 8.* 1904.